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GOVERNOR



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EMPLOYEES' RETIREMENT SYSTEM  
HAWAII EMPLOYER UNION HEALTH BENEFITS TRUST FUND  
OFFICE OF THE PUBLIC DEFENDER

**STATE OF HAWAII**  
**DEPARTMENT OF BUDGET AND FINANCE**  
P.O. BOX 150  
HONOLULU, HAWAII 96810-0150

ADMINISTRATIVE AND RESEARCH OFFICE  
BUDGET, PROGRAM PLANNING AND  
MANAGEMENT DIVISION  
FINANCIAL ADMINISTRATION DIVISION  
OFFICE OF FEDERAL AWARDS MANAGEMENT (OFAM)

**WRITTEN ONLY**

TESTIMONY BY WESLEY K. MACHIDA  
DIRECTOR, DEPARTMENT OF BUDGET AND FINANCE  
TO THE HOUSE COMMITTEES ON ENERGY & ENVIRONMENTAL PROTECTION  
AND ON WATER & LAND  
ON HOUSE BILL NO. 634

**February 16, 2017**

**11:00 A.M.**

**Room 325**

RELATING TO THE ISSUANCE OF SPECIAL PURPOSE REVENUE BONDS FOR  
THE NUUANU HYDROELECTRICITY PROJECT

House Bill No. 634 authorizes the issuance of Special Purpose Revenue Bonds (SPRB) up to \$4,800,000 to assist the Honolulu Board of Water Supply and the Hawaiian Electric Company, Inc. to upgrade Nuuanu Reservoir #1 to meet State Dam Safety Standards, as a component of the Nuuanu Hydroelectricity Project pursuant to Part VI, Chapter 39A, Hawaii Revised Statutes.

The Department is providing comments only to advise the Legislature and prospective SPRB parties that should the legislation be approved, approval of the SPRB issuance and conduit loan will require further review of the financing proposal to ensure compliance with all federal, state and credit underwriting requirements. For additional information, please consult our FAQ located at the following link:

<http://budget.hawaii.gov/wp-content/uploads/2012/11/SPRB-FAQ.pdf>.

Thank you for your consideration of our comments.

DAVID Y. IGE  
GOVERNOR OF HAWAII



**STATE OF HAWAII**  
**DEPARTMENT OF LAND AND NATURAL RESOURCES**

POST OFFICE BOX 621  
HONOLULU, HAWAII 96809

**Testimony of**  
**SUZANNE D. CASE**  
**Chairperson**

**Before the House Committees on**  
**ENERGY & ENVIRONMENTAL PROTECTION**  
**and**  
**WATER & LAND**

**Thursday, February 16, 2017**  
**11:00 A.M.**  
**State Capitol, Conference Room 325**

**In consideration of**  
**HOUSE BILL 634**  
**RELATING TO THE ISSUANCE OF SPECIAL PURPOSE REVENUE BONDS**  
**FOR NU‘UANU HYDROELECTRICITY PROJECT**

House Bill 634 proposes to authorize the issuance of special purpose revenue bonds to the Board of Water Supply and the Hawaiian Electric Company, Inc. to upgrade Nu‘uanu Reservoir #1 to meet State Dam Safety Standards, as a component of the Nu‘uanu Hydroelectricity Project. **The Department of Land and Natural Resources (Department) supports this measure as it could assist the dam and reservoir owner by providing an economic means to bring their facilities up to current safety standards, enhance groundwater recharge in the upper Nu‘uanu watershed, and aid the State in developing renewable energy projects.**

Nu‘uanu Reservoir #1 is one of four reservoirs developed for potable water supply in the early 1900s and was part of a hydroelectric system that generated electricity in Honolulu prior to the 1930s. The Nu‘uanu Reservoir #1 is a regulated dam under the Department’s Dam and Reservoir Safety Program as it has a height of 33 feet and rated storage capacity of over 21million gallons of water. The dam is in poor condition and may have an inadequately sized spillway and lacks a functioning outlet works. Due to its close proximity to downstream residential areas, it is classified as a High Hazard Potential Dam.

Thank you for the opportunity to comment on this measure.

**SUZANNE D. CASE**  
CHAIRPERSON  
BOARD OF LAND AND NATURAL RESOURCES  
COMMISSION ON WATER RESOURCE MANAGEMENT

**KEKOA KALUHIWA**  
FIRST DEPUTY

**JEFFERY T. PEARSON, P.E.**  
DEPUTY DIRECTOR - WATER

AQUATIC RESOURCES  
BOATING AND OCEAN RECREATION  
BUREAU OF CONVEYANCES  
COMMISSION ON WATER RESOURCE MANAGEMENT  
CONSERVATION AND COASTAL LANDS  
CONSERVATION AND RESOURCES ENFORCEMENT  
ENGINEERING  
FORESTRY AND WILDLIFE  
HISTORIC PRESERVATION  
KAHOOLAWE ISLAND RESERVE COMMISSION  
LAND  
STATE PARKS



**TESTIMONY OF  
THE DEPARTMENT OF THE ATTORNEY GENERAL  
TWENTY-NINTH LEGISLATURE, 2017**

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**ON THE FOLLOWING MEASURE:**

H.B. NO. 634, RELATING TO THE ISSUANCE OF SPECIAL PURPOSE REVENUE BONDS FOR THE NUUANU HYDROELECTRICITY PROJECT.

**BEFORE THE:**

HOUSE COMMITTEES ON ENERGY AND ENVIRONMENTAL PROTECTION  
AND ON WATER AND LAND

**DATE:** Thursday, February 16, 2017      **TIME:** 11:00 a.m.

**LOCATION:** State Capitol, Room 325

**TESTIFIER(S):** Douglas S. Chin, Attorney General, or  
Randall S. Nishiyama, Deputy Attorney General

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Chairs Lee and Yamane and Members of the Committees:

The Department of the Attorney General provides the following comments regarding this bill.

This bill authorizes pursuant to part VI, chapter 39A, Hawaii Revised Statutes, the issuance of \$4,800,000 in special purpose revenue bonds ("SPRBs") to assist the Honolulu Board of Water Supply, a municipal water utility, and Hawaiian Electric Company, Inc., an electric utility, "to upgrade Nuuanu reservoir #1 to meet state dam safety standards as part of the Nuuanu hydroelectricity project." According to the bill, the Nuuanu hydroelectricity project is intended to generate hydroelectric energy and provide off-peak energy storage, and also to "supplement usable groundwater supplies through the increase of groundwater recharge of captured stormwater."

We have the following comments regarding this bill:

While this bill states that the SPRBs will benefit the Honolulu Board of Water Supply and Hawaiian Electric Company, it is not clear who the borrower will be. We recommend that the wording of the bill specify whether it is both of these parties or just the Hawaiian Electric Company.

It is not clear whether the project is an electric utility or a water project or both. More information is needed to clarify this matter and to further describe what is being financed.

We will be happy to work with the Committees regarding our concerns.

Thank you for the opportunity to testify on this matter.

# BOARD OF WATER SUPPLY

CITY AND COUNTY OF HONOLULU  
630 SOUTH BERETANIA STREET  
HONOLULU, HI 96843  
www.boardofwatersupply.com



February 16, 2017

KIRK CALDWELL, MAYOR

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ADAM C. WONG, Vice Chair  
DAVID C. HULIHEE  
KAPUA SPROAT  
KAY C. MATSUI

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FORD N. FUCHIGAMI, Ex-Officio

ERNEST Y. W. LAU, P.E.  
Manager and Chief Engineer

ELLEN E. KITAMURA, P.E.  
Deputy Manager and Chief Engineer *ell*

The Honorable Chris Lee, Chair  
and Members  
Committee on Energy & Environmental Protection  
House of Representatives  
Hawaii State Capitol, Room 436  
Honolulu, Hawaii 96813

The Honorable Ryan I. Yamane, Chair  
and Members  
Committee on Water & Land  
House of Representatives  
Hawaii State Capitol, Room 420  
Honolulu, Hawaii 96813

Dear Chair Lee, Chair Yamane, and Members:

Subject: House Bill 634, Relating to the Issuance of Special Purpose  
Revenue Bonds for the Nuuanu Hydroelectricity Project

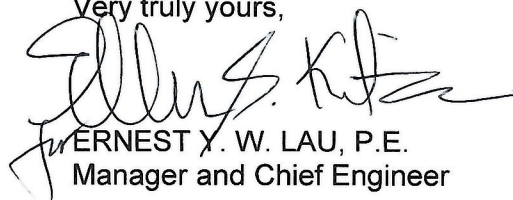
We strongly support House Bill 634, which authorizes the issuance of special purpose revenue bonds to upgrade the Nuuanu Reservoir No. 1 to meet State dam safety standards, provide adequate flood control for Waolani Stream and become an essential receiving reservoir as part of a proposed Nuuanu hydroelectric and managed aquifer recharge project.

The proposed Nuuanu hydroelectric project will drop captured storm water from Nuuanu Reservoir No. 4 to Nuuanu Reservoir No. 1 to generate renewable hydroelectric energy to help meet peak energy demands and recharge the groundwater aquifer supplying the Board of Water Supply's Kalihi Pump Station, an important drinking water source as a climate change adaptation measure.

This project will help Hawaii meet its renewable energy and water sustainability goals while increasing dam safety and flood control at Nuuanu Reservoir No. 1. We attach a project factsheet for your information.

Thank you for your consideration of our supporting testimony on House Bill 634.

Very truly yours,

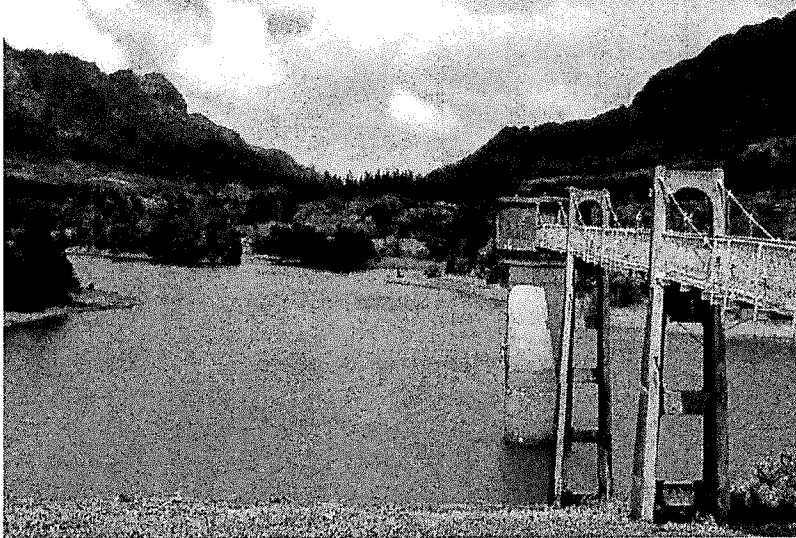
  
ERNEST Y. W. LAU, P.E.  
Manager and Chief Engineer

Attachment

Project  
Description

# Nu'uaniu Managed Aquifer Recharge and Pumped Storage Hydroelectricity Project

Nu'uaniu Reservoir #4



## SUMMARY OF BENEFITS

The Board of Water Supply has identified a project connecting existing reservoirs in the Nu'uaniu Valley to generate renewable hydroelectric energy, provide energy storage to help meet peak energy demands using off-peak solar or wind supplies, and supplement usable groundwater supplies for drinking water purposes through the increase of groundwater recharge of captured stormwater.

**This project will help Hawaii meet its renewable energy and water sustainability goals while increasing dam safety and flood control at two Nu'uaniu reservoirs.**

## Introduction

Groundwater resources on O'ahu provide 100% of the drinking water that the Board of Water Supply (BWS) provides to its 1 million customers. University of Hawaii studies of climate change impacts indicate that groundwater availability will be adversely affected by decreased rainfall and increased temperatures. Consequently, there is a clear need for projects that enhance the island's irreplaceable groundwater resource.

Two alternative projects that enhance groundwater recharge and sustainability are being considered by the BWS. Both projects demonstrate the productive collaboration between the BWS and Hawaiian Electric that could increase the island's groundwater supply while also advancing the state's renewable energy goals.

Both projects capitalize on the use of two existing BWS stormwater reservoirs in the Nu'uaniu Valley—Reservoir #1 which was constructed in 1889 and Reservoir #4 which was completed in 1910. The 600-ft elevation difference between the two reservoirs provides the opportunity to generate renewable power when water is moved downhill. By injecting some of this water into the underlying Kalihi groundwater aquifer, which is used by the BWS for water supply, beneficial use of this water resource becomes possible. Due to its location, the stormwater in Reservoir #4 is not available for eventual water supply use and eventually flows unused to the ocean.

## COST AND SCHEDULE

The two alternatives have a total cost ranging from **\$28 to \$51 million dollars**. Project work on dam improvements for Reservoir No. 4 could begin immediately. Startup of the hydropower facilities would occur by year 2025.



## Project Setting

Nu'uano Reservoir #4 and Nu'uano Reservoir #1 are located approximately two miles apart in the Nu'uano Valley above the City of Honolulu (see Figure 1). Historically, the Nu'uano reservoirs were connected as part of a hydroelectric project. The powerhouse at Nu'uano #1 was commissioned by Princess Ka'iulani on March 23, 1888 to light the electric street lamps in downtown Honolulu. The remains of the pipeline and powerhouse are still visible within the forest near Reservoir #1 along Pali Highway.

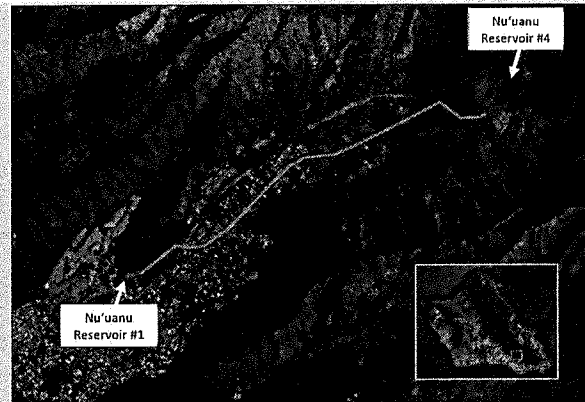


Figure 1. Potential pipeline alignment for the Nu'uano Managed Aquifer Recharge and Pumped Storage Hydroelectric Projects

**Project Alternative No. 1 is the Nu'uano Managed Aquifer Recharge Hydroelectric Project.** Stormwater captured in Reservoir #4 would be piped through a new 12-inch pipeline in Old Pali Road, through a new hydroelectric facility located adjacent to Reservoir #1. Other facilities would include a sediment filter for pre-treatment which would be located near Nu'uano Reservoir #2 approximately halfway along the pipeline alignment. A set of injection wells would be located near Reservoir #1 to recharge the groundwater aquifer with the outflow of the hydroelectric plant (See Figure 2 for schematic).

**Project Alternative No. 2 is the Nu'uano Pumped Storage Hydroelectric Project.** This project is similar to Alternative No. 1 but adds the capability of pumped-storage hydroelectricity, a type of energy storage used by electric power systems for load balancing. Energy from intermittent and/or off peak sources such as wind or solar is stored in the form of gravitational potential energy of water, pumped from a lower elevation reservoir (Reservoir #1) to a higher elevation (Reservoir #4) using low-cost, off-peak electric power. During periods of high electrical demand (typically 5 to 9 p.m. on O'ahu), the stored water is released through turbines to produce electric power. This project would require a significantly larger (30-inch) pipeline to allow 10 million gallons of water to flow to Reservoir #1 during the peak electrical demand period which increases project cost. (See Figure 3 for schematic).

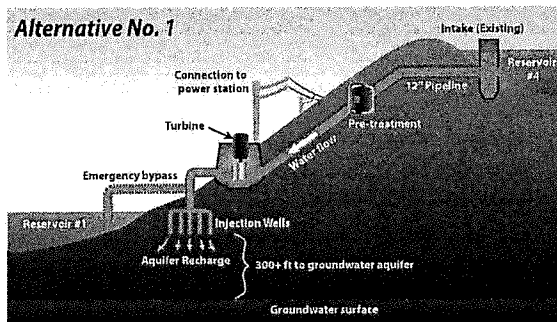


Figure 2. Schematic of Nu'uano Managed Aquifer Recharge Hydroelectric Project

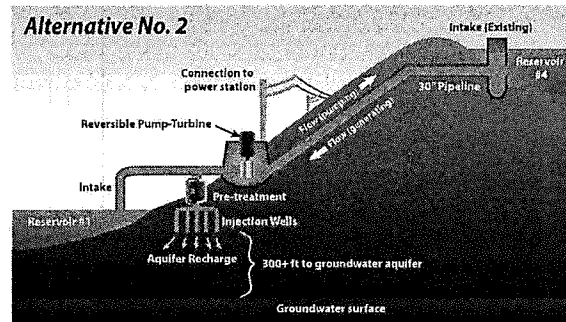


Figure 3. Schematic of Nu'uano Managed Aquifer Recharge and Pumped Storage Hydroelectric Project

Pre-treated water injected into the ground near Reservoir #1 benefits from natural treatment within the soils. This water will travel 5 to 10 years before it reaches the existing BWS supply wells in Kalihi.



**Table 1. Comparison of Features of the Nu'uano Managed Aquifer Recharge and Pumped Storage Hydroelectric Projects**

	Water Supply Benefit	Renewable Power Capacity and Hours	Energy Storage
Alternative 1: Managed Aquifer Recharge Hydroelectric Project	1 – 2 mgd	0.14 MW running 24 hrs/day	No
Alternative 2: Pumped Storage Hydroelectric Project	1 – 2 mgd	4 MW typically 5 p.m. to 9 p.m.	Yes

In addition to the pipeline, power production and groundwater injection facilities, both reservoirs include safety upgrades mandated by State Dam Safety standards.

**Table 2. Comparison of Capital Costs for the Two Alternative Projects**

Project Component	Alternative No. 1	Alternative No. 2
Upgrade Nu'uano Reservoir #4 to meet State Dam Safety Standards	\$6.4	\$6.4
Upgrade Nu'uano Reservoir #1 to meet State Dam Safety Standards	\$4.8	\$4.8
Design, permit and construct Managed Aquifer Recharge Hydroelectric Project	\$12.0	–
Design, permit and construct Pumped Storage Hydroelectric Project	–	\$31.0
Contingency @ 20%	\$4.6	\$8.4
<b>Total (\$M)</b>	<b>\$27.8</b>	<b>\$50.6</b>

The above costs (in millions of dollars) are inclusive of planning, permitting, design, construction, inspection, startup and a 20% planning level contingency. Financing costs are not included.

## Project Benefits

The benefits of a Managed Aquifer Recharge and Pumped Storage Hydroelectricity Project in Nu'uano Valley include:

- Increased useable water supply through recharge of captured stormwater that increases the sustainability of groundwater supply and could delay the need for future supply development.
- Development of a source of renewable energy supply during peak energy use periods.
- Increased dam safety and flood control.
- Creation of energy storage (Alternative No. 2 only) that could be used to “time-shift” surplus energy production during off-peak hours to meet peak hour demands, reducing the load on existing fossil-fuel based peaking supplies.

## Project Timetable

The preliminary timetable for the Managed Aquifer Recharge and Pump Storage Hydroelectricity Project will include planning (preliminary design, environmental assessment, and permitting) in FY18 to FY20, design in FY21/22, and construction from FY23 to FY26. Upgrades to Nu'uano Reservoir #4 will be constructed in FY18 and Nu'uano Reservoir #1 will be designed in FY19/20 and constructed in FY20/21.

	FY17	FY18	FY19	FY20	FY21	FY22	FY23	FY24	FY25	FY26
Nu'uano Managed Aquifer Recharge and Pump Storage Hydroelectricity Project										
Nu'uano Reservoir #4 Upgrades										
Nu'uano Reservoir #1 Upgrades										

■ Planning ■ Design ■ Construction

Figure 4. Estimated Timeline of Nu'uano Managed Aquifer Recharge and Pump Storage Hydroelectricity Project

## Summary

Implementation of this opportunity would allow the BWS to develop a project that increases the island’s groundwater supply, advances the state’s renewable energy goal, and ultimately helps keep water rates affordable for BWS customers.





Email: [communications@ulupono.com](mailto:communications@ulupono.com)

HOUSE COMMITTEES ON ENERGY & ENVIRONMENTAL PROTECTION AND WATER &  
LAND

Thursday, February 16, 2017 — 11:00 a.m. — Room 325

**Ulupono Initiative Strongly Supports HB 634, Relating to the Issuance of Special Purpose Revenue Bonds for the Nuuanu Hydroelectricity Project**

Dear Chair Lee, Vice Chair Lowen, Chair Yamane, Vice Chair Kong, and Members of the Committees:

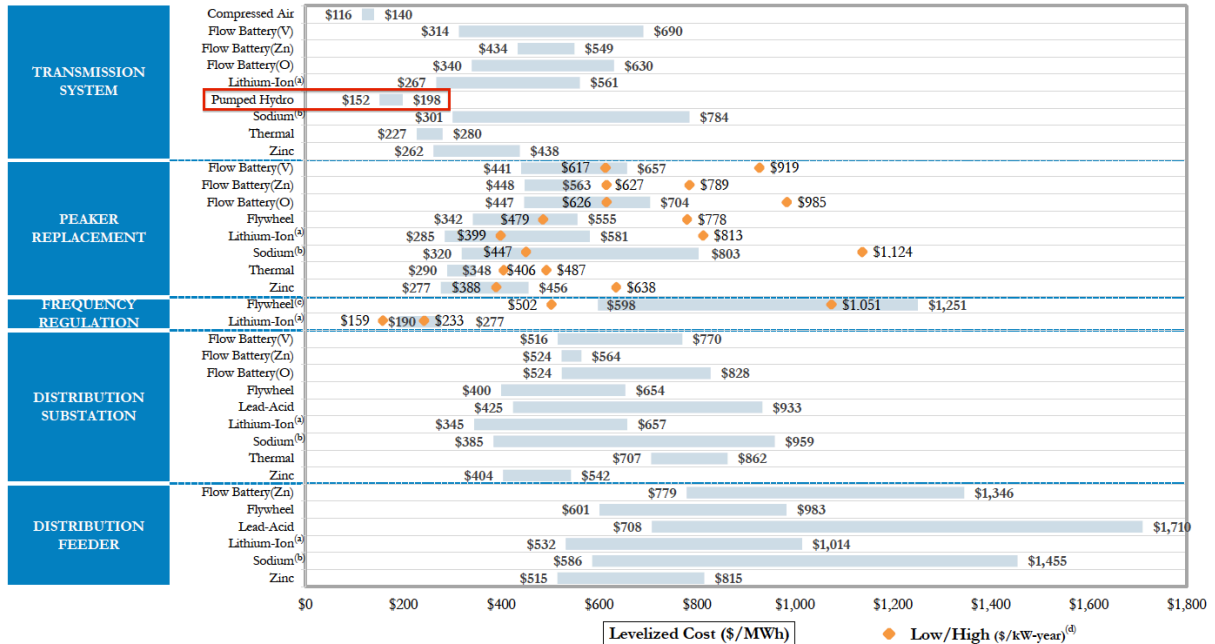
My name is Murray Clay and I am Managing Partner of the Ulupono Initiative, a Hawai'i-based impact investment firm that strives to improve the quality of life for the people of Hawai'i by working toward solutions that create more locally produced food; increase affordable, clean, renewable energy; and reduce waste. Ulupono believes that self-sufficiency is essential to our future prosperity and will help shape a future where economic progress and mission-focused impact can work hand in hand.

**Ulupono strongly supports HB 634**, which authorizes special purpose revenue bonds for upgrading Nuuanu Reservoir #1 for a hydroelectric project, because it aligns with our goal of increasing the production of clean, renewable energy in Hawai'i.

Pumped storage hydro is one of the cheapest forms of energy storage currently available. The chart below indicates the price ranges for different types of energy storage.

*Investing in a Sustainable Hawai'i*

## Unsubsidized Levelized Cost of Storage Comparison



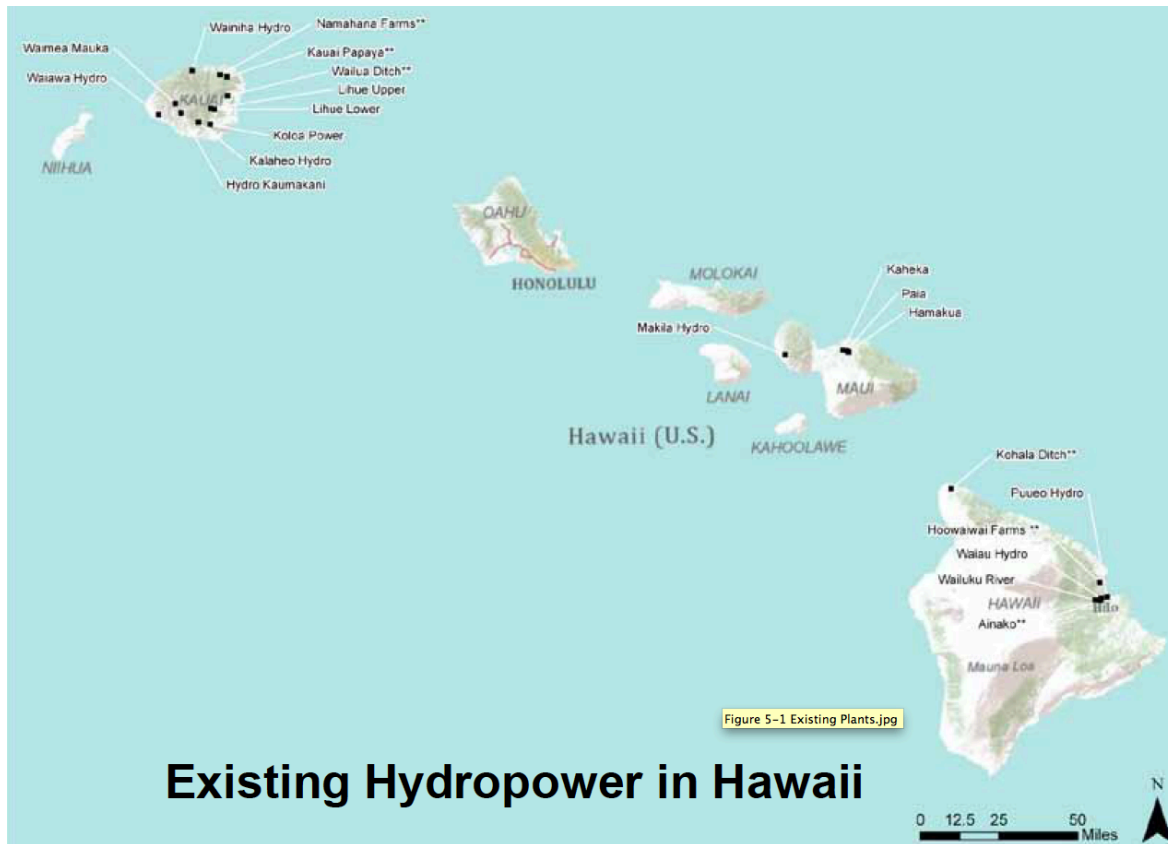
Source: Lazard and Enovation Partners estimates.

Note: Flow Battery(V) represents Vanadium Flow Batteries; Flow Battery(Zn) represents Zinc-Bromine Flow Batteries; Flow Battery(O) represents Other Flow Batteries. Lazard's LCOS v1.0 study did not separately analyze each of these distinct technologies within Flow Battery.

- (a) Lithium-Ion-Power technology used in the Frequency Regulation and Microgrid Use Cases due to low duration/high power requirements. Lithium-Ion-Energy systems are used in all other Use Cases that include Lithium-Ion technology.
- (b) Sodium-Low Temperature systems are used in Commercial Appliance and Residential Use Cases. Sodium-High Temperature systems are used in all other Use Cases that utilize Sodium technology.
- (c) Flywheel storage in the Frequency Regulation Use Case represents short-duration storage. Flywheel storage in all other Use Cases represents long-duration storage.
- (d) Reflects conversion of LCOS figure (\$/MWh) by multiplying by total annual energy throughput (MWh) and dividing by capacity (kW).

With high intermittent renewable energy production, Hawai'i requires more energy storage to increase its use of additional renewable energy sources. Yet, there are few locations, particularly on O'ahu where power demand is highest amongst all Hawai'i counties, that a pumped storage hydro project makes topographic and economic sense. Nuuanu reservoirs provide an opportunity to develop a needed energy project using reservoir infrastructure that exists.

Currently, hydroelectric projects exist in all of Hawai'i's counties except Honolulu. Hydroelectric power production is highest on Kauai where it provides 7.5 percent of the island's electricity.



The combined statewide hydroelectric plants have a total generating capacity of about 37 megawatts, which is approximately equal to the generating capacity of a 70 megawatt solar farm. Hydroelectric plants also replace 250,000 barrels of oil equivalent. Hydroelectric plants statewide would represent 1.67 percent of O‘ahu’s 2016 generating capacity and roughly 0.49 percent of the state’s primary energy production.

As Hawai‘i’s energy issues become more complex and challenging, we appreciate this committee’s efforts to look at policies that support renewable energy production.

Thank you for this opportunity to testify.

Respectfully,

Murray Clay  
Managing Partner

February 16, 2017

Testimony support for water conservation regarding bill numbers:  
HB 634 and HB 635

Rachel Sherman  
425 Ena Rd. #1107B  
Honolulu, HI 96815  
[shermanrms@msn.com](mailto:shermanrms@msn.com)

Aloha,

As an engaged citizen of Hawai`i and graduate student in the sustainability discipline, I am writing in support of bill numbers: HB 634 and HB 635 - Water Conservation Device Rebate.

These bills will support the conservation of Hawai`i's fresh water resource. As reported by the Hawaii community Foundation's *Freshwater Blueprint for Action*, fresh water security on Oahu is forecasted to become compromised due to decreased annual rainfall and increased usage due to population growth.

These bills will also support the economy through decreasing utility costs to citizens and the community.

Passing these bills demonstrate support of our legislature's sustainability goals to protect our watersheds and the economic interests of our citizens.

Sincerely,

Rachel Sherman